# Space Weather Technical Forecast

Issued on Thursday, 30 June 2022 at 13:20 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

**Space Weather Forecast Headline: Active electron fluence continuing. Slight chance of M-class flares.**

**Analysis of Space Weather Activity over past 24 hours**
**Solar Activity:** Solar activity has been Low over the last 24 hours, with one C1.4 flare from a new region which is just rotating onto the northeast limb. This region is currently difficult to analyse due to its position, but will continue to be monitored. There are three further regions on the visible disc, with 3040 (Dso/Beta) stable and 3042 (Cro/Beta) declining. AR3045 (Cri/Beta) in the southeast quadrant also appears stable. No Earth-directed CMEs were observed in available imagery.

**Solar Wind / Geomagnetic Activity:** The solar wind speed, as observed at L1 has followed a declining trend through the last 24 hours and has now reached 400km/s from a peak of 475km/s. Density has been mainly around or below average. Total interplanetary magnetic field was weak, with the north-south component, Bz, varying weakly. Phi angle has been mainly negative (towards the Sun). Resultant geomagnetic activity was Quiet.

**Energetic Particles / Solar Radiation:** The high energy proton flux (10 MeV) as measured by GOES16 remained at background levels throughout the period. High energy electron flux was high throughout, with a peak of 4.0e3 pfu at 30/0835UTC. Corresponding electron fluence was above the Active (1e8 integrated pfu) threshold with an overall flat trend. An observed fluence of 1.61e8 integrated pfu was recorded at 30/0000 UTC.

**Four-Day Space Weather Forecast Summary**
**Solar Activity:** Solar activity is likely to be Low or Very Low, with a slight chance of Moderate activity

**Solar Wind / Geomagnetic Activity:** A slow CME which left the Sun on 26 June may arrive at Earth on 02 July, but may be engulfed by the ambient solar wind. A further CME may arrive at Earth by the end of 04 July, but with low confidence. Solar wind speeds are expected to reach and remain at ambient levels through the period. Geomagnetic activity is forecast to be mainly Quiet, with isolated Unsettled intervals.

**Energetic Particles / Solar Radiation:** In the absence of any significant sunspot development, the high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The diurnal peaks of the high energy electron flux (greater than 2MeV) are expected to follow a slowly declining trend through the next four days, but still to reach high levels on the peak. Electron fluence is forecast to start to slowly decline, but is unlikely to fall below the Active threshold until day 3 (02 July).

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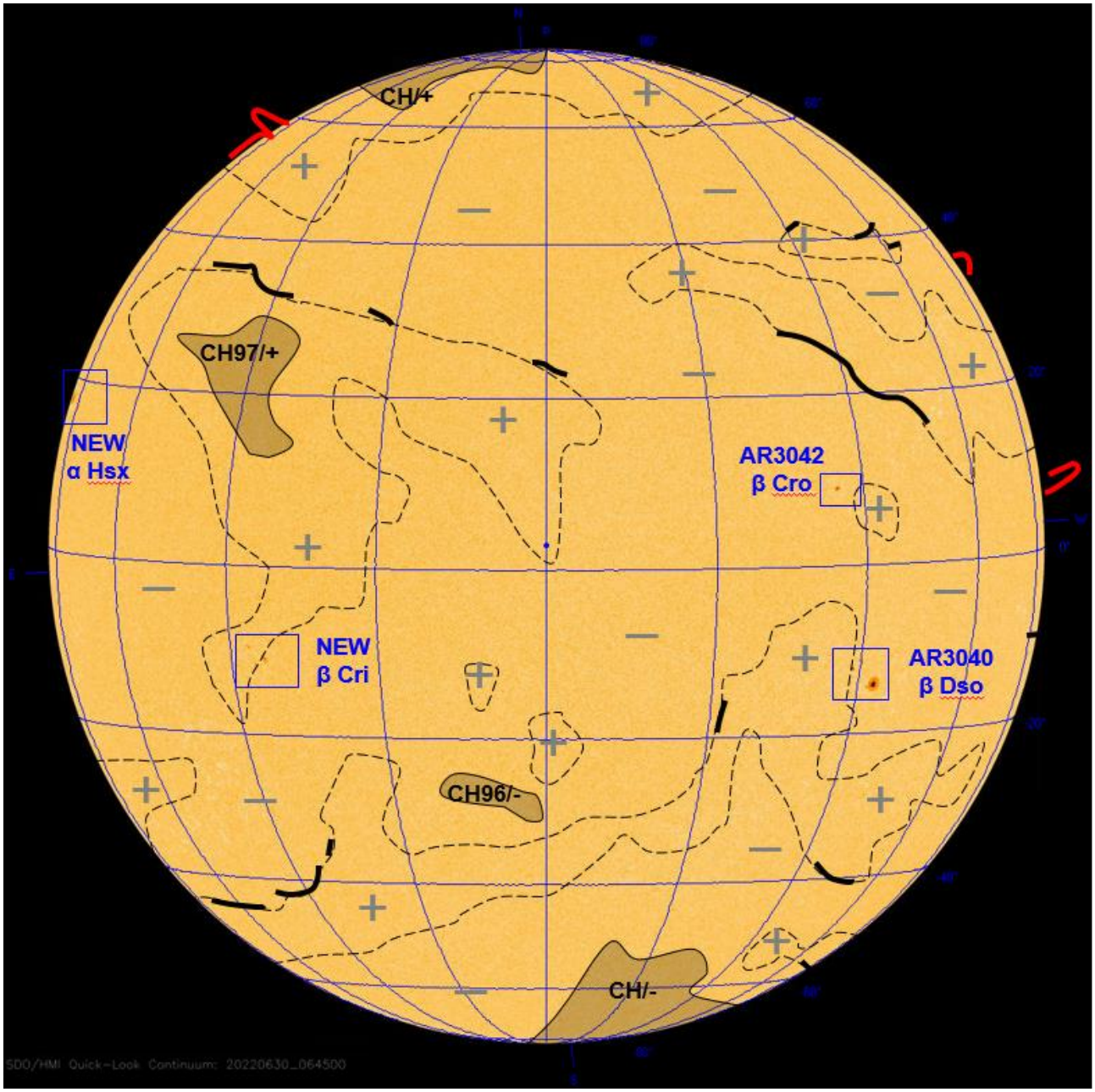
**Figure 1. Solar Analysis Valid 30/0800UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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# Met Office Space Weather Technical Forecast

## Geomagnetic Storms:

A CME which left the Sun on 26 June, may arrive at Earth on 02 July, however the speed is slow, so the feature may merge with the background solar wind. A further CME which left the Sun on 28 June is currently forecast to arrive at Earth either late on 04 July, or during 05 July. Three further CMEs from the last 24 hours are currently being assessed, although two of these appear to have emanated from the far side of the Sun.

Solar winds are declining as the effects of coronal holes 93 and 94 continue to wane, with background levels expected by the end of day 1 (30 June). No further enhancements are then expected within the forecast period.

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals.

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 1 | 1 | 1 | 1 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Radio Blackouts - X-Ray Flares:

Solar activity has been Low through the last 24 hours, with one C-class flare observed from a plage region rotating onto the northeast limb. This unnumbered region is likely to reveal increasing complexity as it rotates further into view. The risk of M-class flares has been increased from day 2 (01 July) due to the potential from this region.

The largest region on the disc, AR3040 (Dso/Beta) appears to be mature and stable. AR3042 (Cro/Beta) is fading to plage. AR3045 (Cri/Beta) the southeast quadrant is currently weak and inactive.

| X Ray Flares Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 M Class | No | 5 | 10 | 10 | 10 |
| Very Active | R3 to R5 X Class | No | 1 | 1 | 1 | 1 |

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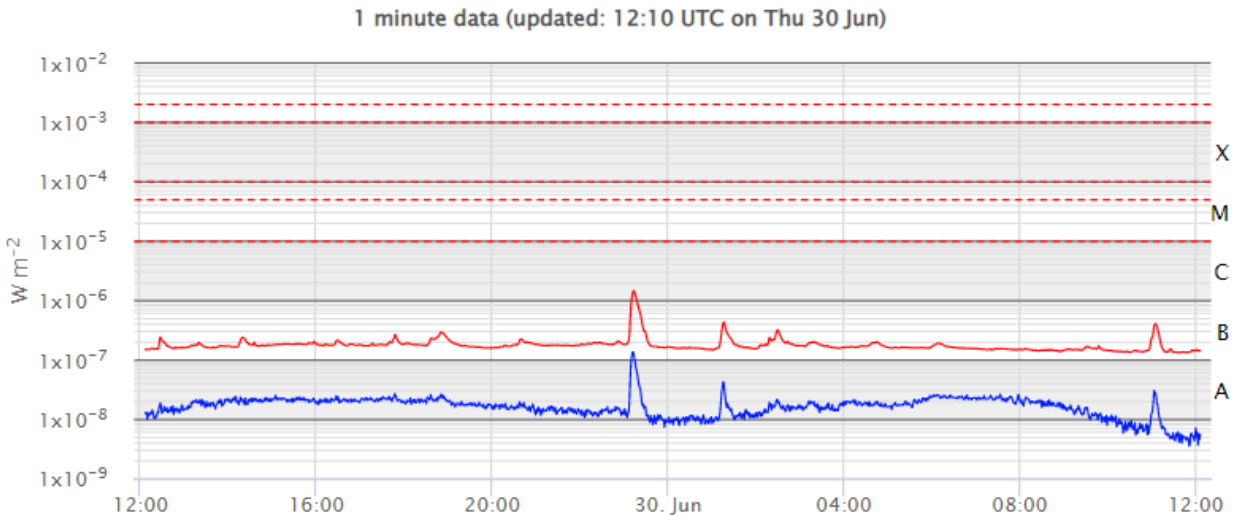
**Figure 2: GOES-16 X-ray flux for the last 24 hours.**




## Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 1 | 1 | 1 | 1 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

## High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) has been at high levels through the last 24 hours and is only expected to decline slowly through the next four days. This is due to a build up of electrons in the radiation belts, with no forecast mechanism for redistribution of the electrons or distortion of the radiation belts. There should be a trend for the peak values to reduce through the next four days as the solar winds reach background levels.

Electron fluence values are forecast to remain above the Active threshold on day 1 and through much of day 2 (30 June and 01 July). A reducing trend is then likely from later day 2 onwards, although this is forecast to be a shallower decline than indicated by the REFM model, with recurrence giving better guidance.

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| GEO Electron Environment<br>Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ 2 MeV ≥ $1x10^8$** | Yes | 100 | 70 | 50 | 20 |
| **Very Active** | **≥ 2 MeV ≥ $1x10^9$** | No | 1 | 1 | 1 | 1 |

**Figure 3: GOES 16 electron flux and MOSWOC REFM model**

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